**The California Fuel Cell Partnership:**
**Facilitating Fuel Cell and Hydrogen Commercialization and**
**Adding Value to California's Hydrogen Highway Network**

As the world's fifth largest economy and the nation's most populous state, California is home to almost 35 million vehicles that travel over 800 million miles per day. The State's reliance on the internal combustion engine has resulted in significant air quality challenges – in 2003, 60% of the state's air pollution came from mobile sources (cars, trucks, buses and other forms of transportation). Over the past forty years, since the adoption of the first motor vehicle emission standard in the world, California has used innovative strategies to improve fuel economy and reduce passenger car emissions to extremely low levels. This has allowed the State to reduce air pollution while at the same time supporting economic growth.

State leadership continues to be at the forefront of the challenges. With the emergence of fuel cells as a promising, potentially viable alternative to the internal combustion engine, the California Air Resources Board and the California Energy Commission teamed up with two auto companies, three energy companies and a fuel cell technology company to form the California Fuel Cell Partnership in 1998. With the common goal of promoting fuel cells as a means of moving toward a sustainable energy and cleaner environmental future, the original eight members set out to develop a new vision for transportation in California. The California Fuel Cell Partnership (CaFCP) has since become the world's preeminent turning plate for fuel cell and hydrogen commercialization activities through real-world demonstration projects and by establishing itself as a center of excellence and knowledge. As governments around the world strive to find solutions to the pressing issues of the day, including energy security, green house gas reductions and the reduction of local air pollutants, the work the CaFCP is undertaking to facilitate commercialization of fuel cells and hydrogen is becoming increasingly important.

The CaFCP is a unique public/private collaboration where the collective knowledge and expertise of its members, currently numbering 30 companies and agencies from California and around the world, is harnessed to address both the technological and societal challenges of commercializing fuel cells. The goal of this activity is to facilitate movement into a 21$^{st}$ century transportation system that utilizes fuel cells and hydrogen and transforms our current system to one that can deliver sustainable transportation and a healthy environment to many generations to come. Battery-powered electric vehicles have offered consumers a glimpse into the benefits of using electric drive systems. Hybrid electric vehicles, now available to the general public, have advanced to commercialization as a result of rapid developments in electric drive systems, and are helping consumers become comfortable with new types of cars. Hydrogen fuel cell vehicles have all the benefits of electric drive technology, such as quick acceleration and on-board power for accessories, without the long refueling times of battery-powered electric vehicles. For this reason, major auto companies and energy companies are working hand-in-hand with technology companies and government agencies, making

significant investments in research, development and demonstration of clean, efficient fuel cell vehicles that utilize hydrogen.

## The Members

The members of the CaFCP represent different business sectors and several levels of government. The corporate or agency objectives and the operating cultures of these organizations may vary significantly, but they have come together in this forum to work toward a common goal.

## Full Members

The full members of the CaFCP, listed below, direct the activity of the organization through their executive representation on a 20-member Steering Team. The full members each contribute toward the common budget of the organization, which covers joint studies and projects, communications and outreach programs, and program management and administration.

*Automotive*

- DaimlerChrysler
- Ford
- General Motors
- Honda
- Hyundai
- Nissan
- Toyota
- Volkswagen

*Energy*

- BP
- ChevronTexaco
- Shell Hydrogen
- ExxonMobil

*Fuel Cell Technology*

- Ballard Power Systems
- UTC Fuel Cells

*Government*

- California Air Resources Board
- California Energy Commission
- `South Coast Air Quality Management District
- U.S. Department of Energy
- U.S. Department of Transportation
- U.S. Environmental Protection Agency

## Associate Members

Associate members provide specific expertise in one or more program areas including:

*Transit Agencies (investing resources to demonstrate fuel cell buses)*

- AC Transit
- Santa Clara VTA
- SunLine Transit Agency

*Hydrogen Providers (investing equipment & expertise to develop hydrogen infrastructure)*

- Air Products and Chemicals,
- Methanex

- Pacific Gas & Electric
- Praxair
- Proton Energy Systems
- Stuart Energy; and
- Ztek

## 2004-2007 Mission

The next four years will see a steady expansion in the number of fuel cell vehicles and hydrogen fueling stations in use in California. After an initial phase of managed vehicle and fueling operations over the past three years, the CaFCP members are now partnering with external companies, government agencies and customers to deliver fuel cell products to a broader audience for demonstration and real-world applications (including local communities through public and private fleet operators). This early phase of commercialization is critical to the long-term success of fuel cell vehicles and hydrogen fueling. Through the fleet programs, CaFCP members will develop nodes of activity anchored by the hydrogen fueling stations that support the vehicles. These centers of activity will be the nuclei of a growing network of hydrogen fueling stations that will ultimately grow to achieve Governor Schwarzenegger's vision of a "Hydrogen Highway" in California.

Many elements are needed to promote the development of a commercial market for fuel cell vehicles and a hydrogen fueling infrastructure. There are still technical challenges that remain, including on-board fuel storage and improved durability of fuel cell products. These are actively being addressed by companies developing technology and products and there is a general optimism within the industry that solutions will be found. However, products must be proven and validated by consumers, which is what the CaFCP is now beginning to do with the local fleet programs in California. There is also significant education and outreach that needs to occur to a broad spectrum of stakeholders (e.g. local government officials need to understand the technology and what it will mean for their community, codes officials need to develop criteria to permit fuel cell vehicle and hydrogen fueling facilities, and first responders need to know how to respond to accidents). Support from community leaders is essential to build public awareness. The CaFCP plays a unique role in gathering together and amplifying the extensive knowledge and experience of all the members to deliver solutions to these challenges.

Specifically, the CaFCP members will work together over the next four years to accomplish the following goals:

1. Facilitate members' placement of up to 300 fuel cell cars and buses into fleets
2. Promote fuel stations to support the vehicle fleets
3. Ensure "common-fit" fueling protocols
4. Prepare communities and train first responders for fuel cell vehicles and hydrogen fueling
5. Promote practical codes and standards

6. Enhance public awareness
7. Exchange information and resources worldwide

The CaFCP members each bring unique expertise to ensure our collective success at achieving these goals. The automotive members are placing vehicles into fleet programs, and are working with hydrogen providers to ensure safety and "common fit" fueling equipment and protocols. The fuel cell technology companies are providing valuable product knowledge and expertise while also learning from the demonstrations in order to build better products. The energy and auto companies are working closely with hydrogen suppliers to ensure codes and standards are met and safe operating protocols are utilized at fueling stations. Industry and government members are working to educate public policy makers while bringing the fuel cell message to stakeholders and the general public, increasing awareness and support for this new technology. A small core staff coordinates the collective worldwide experience of CaFCP's members to bring it to fruition in California. By providing a forum for joint learning, cooperation and communication, the CaFCP promotes cross-industry and industry-government understanding as well as resolution of challenging technical and public policy issues. Collaborative projects and shared experiences provide output to members and the interested public that can facilitate the path to fuel cell vehicle commercialization.

## Accomplishments to date

Over the past 5 years, the CaFCP has established itself as the premier fuel cell vehicle demonstration program in the world. Advocates have looked to the CaFCP to learn how to establish similar programs in their own states and countries. Fuel cell demonstration programs have been established in Japan, Germany and Canada, along with many other countries around the world. Among its members, the CaFCP has proven its value as a forum where the challenges of fuel cell vehicle commercialization are tackled by a diverse group of industry and government representatives. Without exception, fuel cell supporters worldwide see the CaFCP as setting the standard for a collaborative approach toward achieving a technology shift that will make hydrogen and fuel cells the preeminent transportation technology of the future. Some specific accomplishments include:

Gained real-world driving data and experience on California roads and highways.

- Placed **55 fuel cell vehicles**;
- Operated **2 fuel cell buses – transit agencies** have placed orders for **seven fuel cell buses** to begin regular transit service in 2004;

Installed supporting infrastructure and gained practical experience with safety and operations.

- Installed and operated **two hydrogen-fueling stations and one methanol fueling station** in California, with nine other hydrogen stations installed and operated independently by members (such as the South Coast AQMD).
- **Promoted fuel station interoperability** among all stations;

- Constructed a **state-of-the-art testing and demonstration facility** in West Sacramento, California.

Conducted joint studies, developed key documents that promote safety and the development of practical codes and standards and held technology forums.

- Commissioned and completed a **fuel scenarios study** examining the benefits and challenges of hydrogen, methanol, gasoline and ethanol;Developed an **emergency response guide for fuel cell vehicles**. This guide is used to train local fire departments and other first responders. **Over 230 emergency response agencies have been trained** to date;
- Initiated a **hydrogen vehicle facilities study** to examine practical facility design for housing and maintaining hydrogen fuel cell vehicles, at dealerships and in garages attached to residential property.
- Hosted **two technology forums** that helped build relationships between CaFCP members and California companies that develop and market advanced technology;

Significantly increased public awareness of hydrogen and fuel cell vehicles.

- Coordinated with key stakeholder groups (e.g. environmental, academic and political leaders) and other fuel cell vehicle projects worldwide. Hosted a **world-wide fuel cell vehicle project forum** in October 2002 and a **communications summit** in October 2003;
- Organized and participated in a **300-mile road rally** that took fuel cell vehicles to local communities along California's Central Coast in 2002. In 2003, organized a **400-mile road rally** through California's Central Valley (Sacramento to Los Angeles) over three days, reaching more than 100,000 people;
- Reached **over 700,000 people** with information regarding fuel cell vehicle and fueling technology with over 12,000 people driving fuel cell vehicles;
- Distributed **2,000 fuel cell learning kits** to California teachers;
- Hosted **over 3800 visitors from 16 countries** to our headquarters in Sacramento;
- Conducted a survey showing that Californian's **awareness of fuel cell technology has increased** from less than 25% in 2000 to about four in ten having heard about the technology in 2003.

## The Path Forward

The CaFCP members and staff are willing and able to help develop and implement Governor Schwarzenegger's Hydrogen Highway plan for California. The near term commercial success of fuel cell vehicles is inextricably linked to the success of the Governor's vision for hydrogen. The CaFCP can provide valuable insight and experience based on our accomplishments and learnings to date including:

1. ***Ensure valuable resources are deployed in the most practical and advantageous manner to maximize the benefit of government and industry investment***

   The CaFCP Steering Team will provide concrete recommendations regarding the planning and implementation of the Hydrogen Highway initiative within the next six months which could include the following:

   - A proposed strategy for siting stations to best support growing vehicle fleets;
   - A proposed strategy to "network" existing and future fuelling stations so that sustainable clusters are strategically developed and linked;
   - A plan to harmonize codes and standards statewide (several CaFCP members are leading experts in codes and standards development in forums worldwide); and
   - Input on public policies to support an emerging fuel cell and hydrogen industry in California.

2. ***Provide insight into the status of development of fuel cell technology, vehicles and fueling stations***

   The CaFCP members can monitor progress and risks as well as the achievement of progam objectives and milestones during the development process in the years ahead in order to support optimum alignment of decisions in investments, infrastructure and vehicle development and production.

3. ***Ensure available hydrogen fueling stations can be used by all fuel cell vehicles to ensure interoperability***

   The CaFCP will provide the latest available fueling interface guidelines as they become available. These guidelines are being developed by CaFCP vehicle and fueling representatives utilizing the real-world laboratory that the CaFCP has established through its existing facilities;

4. ***Streamline interface and standard user agreements between fuel station owners and vehicle users to remove barriers to station usage.***

   The CaFCP will offer a template to streamline the development of future agreements between fuel station owners and vehicle users. This may help avoid the need for numerous dissimilar agreements among different fuel station and vehicle owners;

5. ***Educate local officials about hydrogen fueling stations to facilitate hydrogen infrastructure proliferation***

   The CaFCP will provide a fuel station implementation resource to better understand fuel station siting, development and permitting processes and issues;

6. ***As required, facilitate strategic partnerships with member organizations to further promote commercialization***

   The CaFCP will provide a single point of contact to coordinate with California agencies. For example, staff can link members with entities that are interested in conducting fleet vehicle or fuel station demonstration programs;

***7. Disseminate information regarding government programs, initiatives or communication materials to partners and other industry members***

   The CaFCP is uniquely positioned to provide a single point of contact to allow the State to more easily coordinate with CaFCP members

***7. Increase public awareness to drive market demand***

   The CaFCP will highlight the State of California's Hydrogen Highway project in its communications and outreach activities and will help support State-sponsored events.

Working together with the State of California, the CaFCP hopes to help realize Governor Schwarzenegger's vision of a Hydrogen Highway. We are all optimistic that our mutual goals can be achieved more quickly and more successfully than if challenges were pursued independently. The next four to six years promise to be an exciting time of innovation and development for a future that will see fuel cells and hydrogen drive our transportation systems into the 21st century.